



# RADIOPROPAGAÇÃO

## Refacção na Atmosfera

Carlos A. Cardoso Fernandes

---

---

---

---

---

---

---

---



## 1. Qual a relação com Radiopropagação ?



---

---

---

---

---

---

---

---



## 2. Introdução

### 2.1 Efeito da refractividade do ar (baixa atmosfera)

Índice de refração:  $n = 1.000300$



Varição vertical do índice de refração:  
Encurvamento das trajetórias

---

---

---

---

---

---

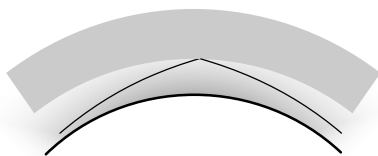
---

---



## 2. Introdução

### 2.2 Ionosfera



$$\text{Índice de refração: } n = \sqrt{1 - \left(\frac{f_p}{f}\right)^2}$$

---

---

---

---

---

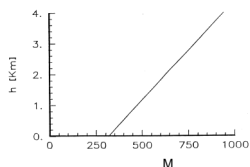
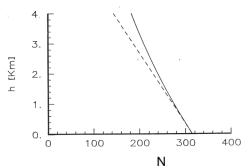
---

---

---



## 3. Variação da refractividade com a altura



---

---

---

---

---

---

---

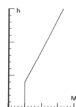
---



## 3. Variação da refractividade com a altura



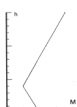
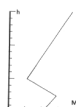
a) Standard



b) Transicional



c) Substandard

d) capação ("trapping")  
superficiale) curva em S  
subelevadaf) curva em S  
junto ao solo

---

---

---

---

---

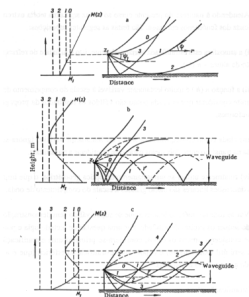
---

---

---



### 3. Variação da refração com a altura



---

---

---

---

---

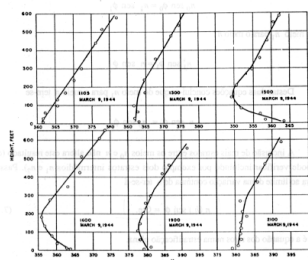
---

---

---



### 3. Variação da refração com a altura



---

---

---

---

---

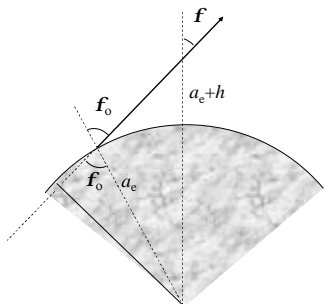
---

---

---



### 4. Raio Equivalente da Terra



---

---

---

---

---

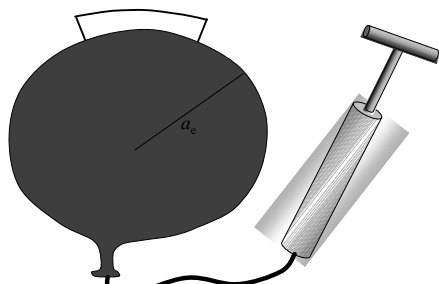
---

---

---



#### 4. Raio Equivalente da Terra



---

---

---

---

---

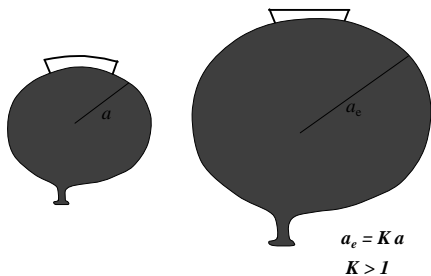
---

---

---



#### 4. Raio Equivalente da Terra



---

---

---

---

---

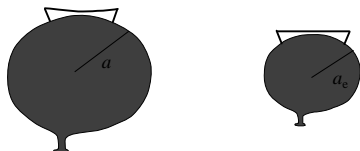
---

---

---



#### 4. Raio Equivalente da Terra



---

---

---

---

---

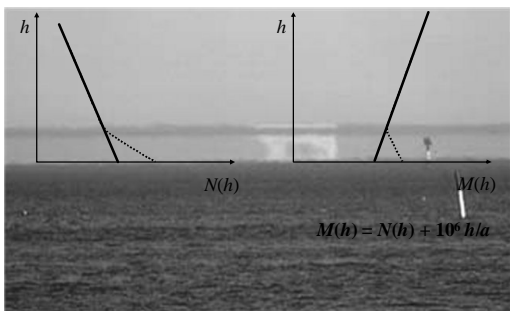
---

---

---



## 5. Camadas de Inversão



carlos.fernandes@lx.it.pt

Departamento de Engenharia Electrotécnica e de Computadores

13

---

---

---

---

---

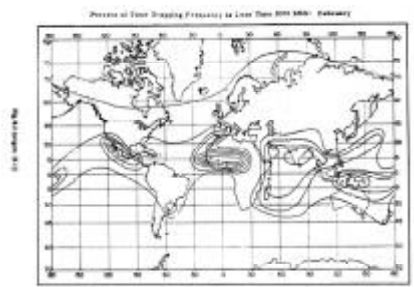
---

---

---



## 6. Ductos



carlos.fernandes@lx.it.pt

Departamento de Engenharia Electrotécnica e de Computadores

14

---

---

---

---

---

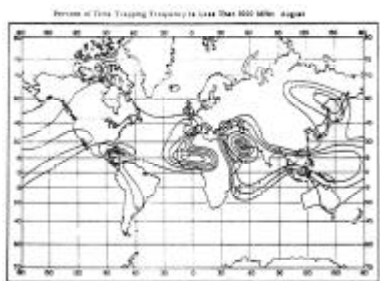
---

---

---



## 6. Ductos



carlos.fernandes@lx.it.pt

Departamento de Engenharia Electrotécnica e de Computadores

15

---

---

---

---

---

---

---

---